AMENDMENTS TO THE DRAWINGS:

The attached sheet of drawings includes a change to figure 4C. This sheet which includes Figures 4C and 4D replaces the original Figures 4C and 4D. In figure 4C the element originally labeled 70 Pocket secondary EOR defects is change to 80 Pocket secondary EOR defects. That is, in figure 4C, the "70" is changed to "80".

Attachment at End of response: Replacement Sheet

Remarks/Arguments

Examiner Perkins is thanked for the thorough Office Action.

In the Claims

Claim 1 is amended to correct a typographical error. I inserted an "and" in step (b).

Claim 1, step (b) is amended to state the pocket implant is comprised of ions "of a ~~second~~ first conductivity type." For support specification p. 11, L 17.

Claim 5 is amended to state "said first conductivity type is N-type and said second conductivity type is p-type. " For support see spec. p. 10, Line 8 (NMOS device has N-type SDE and S/D; NMOS device as P-type pocket regions). Claim 5 also is amended to " implanting As, Si , or Ge ~~or N~~ species". For support see spec. p. 13, LL 4-8.

Parent claim 8 is amended (similar to claim 1) to "of a ~~second~~ first conductivity type.". For support see claim 1 above.

Claim 8, step c is amended to add "the shallow amorphizing implant comprises: implanting ions of Si, As, or Ge species;" for support see claim 5. See spec. p. 13, lines 4 to 8.

Claim 12 is amended to " implanting As, Si , or Ge ~~or N~~ species." For support see above amended claim 8, step c.

Parent claim 17, step b is amended to add the limitation that the pocket amorphizing implants ion of the 1st conductivity type. For support specification p. 11, L 17. See amended claim 1.

New claim 21 depends from claim 1. For support see claim 5 and spec. page 13, line 5. The spec discloses implanting Si or Ge, which can not be halo implant species. Halo implants are doped with the same impurity type as the substrate near the channel and the opposite impurity as the S/D regions.

New Claim 22 depends from claim 1. For support see claim 5.

Parent Claim 8 is amended to add the limitation of "the shallow amorphizing implant comprises: implanting As, Si, or Ge species:". For support see claim 12.

Claim 20 is amended. For support see claim 5.

New claim 21 is added. For support see spec. p. 12, L 15 to p. 13, L 21. No where does the spec say the amorphous shallow implant region 42 is a halo region nor does it say that the impurity type is the opposite the SDE or S/D. No new matter is added.

New dependent claim 22 is added that depends from parent claim 17. For support see claim 8.

New claim 23 is added. for support see spec. p. 13, L 4 and 5.

AMENDMENTS TO THE DRAWINGS:

The attached sheet of drawings includes a change to figure 4C. This replacement sheet which includes Figures 4C and 4D and replaces the original Figures 4C and 4D. In figure 4C the element originally labeled "70 Pocket secondary EOR defects" is change to --80 Pocket secondary EOR defects--. That is, in figure 4C, the "70" is changed to "80".

For Support see specification p. 17, L 17 -19. No New matter is added.

CLAIM REJECTIONS:

Rejection of claims 5, 12, and 20 under 35 U.S.C. §112 is acknowledged. Reconsideration is respectfully requested.

Claims 5, 12 and 20 are amended to remove the word "preferably".

CLAIM REJECTIONS UNDER 35 U.S.C. 103(A)

The Rejection Of Claims 1, 2, 8 and 9 under 35 U.S.C. 103(a) as being unpatentable over Saha (6,344,405) in view of Lee (5,937,293).

The rejection of Claim 1, 2, 8 and 9 under 35 U.S.C. 103(a) as being unpatentable over Saha (6,344,405) in view of Lee (5,937,293) is acknowledged.

1. Review applicant's invention

Applicants' wish to briefly point up some examples of the claimed features of their invention which we believe are not shown nor are obvious form the teachings of known references in this field. Our Claims all clearly define a process comprising:

a) performing a pocket **amorphizing** implantation procedure to implant ions of a first conductivity type to form a pocket implant region adjacent to said gate structure, and an **amorphous** pocket region;

b) performing a shallow amorphizing implant to form **an amorphous shallow implant region**;

In other aspects, the **an amorphous shallow implant region** is either not doped (neutral) or doped with the same impurity type as the S/D or SDE (i.e. opposite impurity the pocket i/i).

The figures below show examples of these steps.

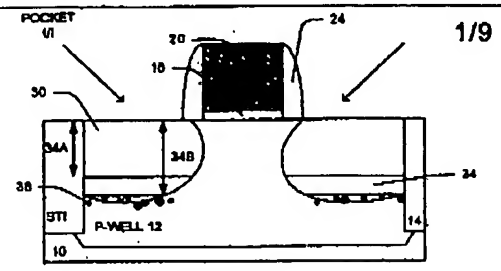


FIGURE 1

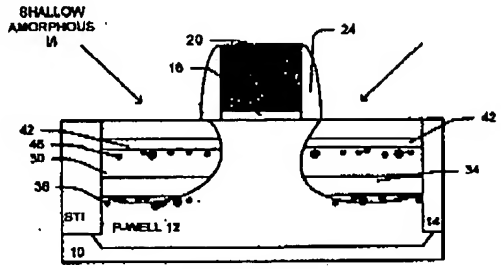


FIGURE 2

Fig 2 - performing a shallow amorphizing implant to form an amorphous shallow implant region;
(counter to the references) * the amorphous shallow implant region has no doping (neutral) or same doping as the S/D and SDE.

Us 6344,405 Saha

Discloses a Tx with 2 Halo regions 108 an 112. The key feature of Saha is that the 2 halo regions allow a peak concentration of substrate impurities at level below the gate... (see saha abstract). Saha does not mention or suggest amorphous or amorphorization implantation process. Saha does not mention of suggest an defect reductions from any implant processes. Saha's 2 halo regions 108 and 112 are both the same impurity type as the substrate. (counter to applicant's claims)

Saha

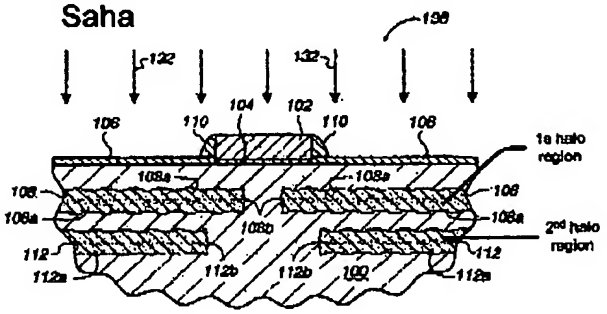
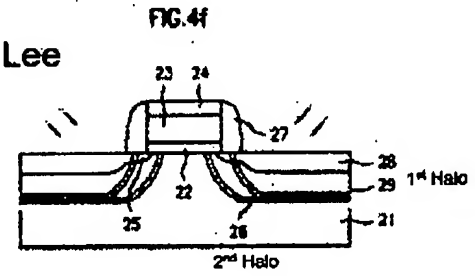


Fig. 5

Lee US 5,937,293

Lee shows another Tx with 1st and 2nd Halo regions 29 26. The purpose is to counter dope the regions surround the S/D in improve the short current effect. (see col. 2, line 31, col 4, L 53-59). Lee's Halo implant are both doped the same as the substrate (counter to applicant's claims).

Lee



Claim 1 is non-obvious over the cited references.

Claim 1 states:

> 1. (CURRENTLY AMENDED) A method for forming an amorphous shallow implant region that getters defects from a pocket implantation; comprising:
>
> a) providing a gate structure, on a substrate comprised with a first conductivity type dopant; said substrate comprised of an upper crystalline section;
>
> b) performing a pocket amorphizing implantation procedure to implant ions of a ~~second~~ first conductivity type to form a pocket implant region adjacent to said gate structure, and an amorphous pocket region;

(1) said amorphous pocket region is formed at a first depth below the substrate surface;

c) performing a shallow amorphizing implant to form an amorphous shallow implant region;

(1) said amorphous shallow implant region being formed at a second depth above said amorphous pocket region;

d) performing an anneal procedure to recrystalize the amorphous shallow implant region and said amorphous pocket region, whereby said amorphous shallow implant region reduces defects formed by the pocket amorphizing implant.

The office action on page 3 posits:

" performing a shallow amorphizing implant to form an amorphous shallow implant region (108); the amorphous shallow implant region (108) being formed at a first depth (Fig. 3k col. 4, lines 15-31)"

However, Saha does not met claim 1, step(c).

c) performing a shallow amorphizing implant to form an amorphous shallow implant region;

(1) said amorphous shallow implant region being formed at a second depth above said amorphous pocket region;

Saha does not teach or suggest that Saha's "shallow halo implant 108" is an **amorphorizing** implant. See Saha col. 4, L 16 to 31, col. 5, LL 40-67.

In contrast to Saha, claim 1, claims performing a shallow **amorphizing** implant to form an **amorphous shallow implant region"** 42 See specification, p 12, L 15 ot p. 13, L 21. Also, See applicant's figures 2, 4A 4B and 4E.

Importantly, Saha as shown in figure 4a does not help remove defects as the application's claimed 1 structure. There no incentive to modify Saha form applicant's amorphous shallow regions.

Combination of Saha and Lee is improper

The combination of Saha and Lee is improper because neither reference suggests they be combined and both patents are complete to themselves.

The office action posits:

> Lee discloses a method for forming an amorphous shallow implant region including providing a gate structure (23), on a substrate (21) (Fig. 4a; col. 3, lines 33-SI); performing a pocket amorphizing implantation procedure to implant ions of a second conductivity type to form a pocket implant region (26) adjacent to the gate structure (23); the amorphous pocket region (26) is formed at a first depth below the substrate surface (21) (Fig. 4c; col. 4, lines 15-20); performing a shallow amorphizing implant to form an amorphous shallow implant region (29); the amorphous shallow implant region (29) being formed at a second depth above the amorphous pocket region (26) (Fig. 4f; col. 4, lines 31-34).

Lee does not suggest or teach applicant's claim 1 and 8's "amorphous shallow implant region"

Lee does not suggest or teach applicant's claim 1 and 8's "amorphous shallow implant region". See Lee col3 L 33 to col. 4, L 56. Lee does not appear to mention amorphous anywhere in his patent.

There is no motivation to modify Lee to meet applicant's claim's 1 and 8.

Claim 8 is non-obvious

The table below compares claim 8 to the Saha and Lee

Claim 8	Saha	Lee
8. (CURRENTLY AMENDED) A method for forming an amorphous shallow implant region that getters defects from a pocket implantation; comprising:		
a) providing a gate structure, on a substrate comprised with a first conductivity type dopant; said substrate comprised of an upper crystalline section;		
b) performing a pocket amorphizing implantation procedure to implant ions of a ~~second~~ first conductivity type to form a pocket implant region adjacent to said gate structure, and an amorphous pocket region; (1)said amorphous pocket region is formed at a first depth below the substrate surface;	No suggestion of "said amorphous pocket region"	No suggestion of "said amorphous pocket region"
c)performing a shallow amorphizing implant to form an amorphous shallow implant region; the shallow amorphizing	Teaches again- Saha teaches a P-type halo implant-	Teaches again- Lee teaches a P-type halo implant-

implant comprises; implanting Si , As, or Ge species;		
said amorphous shallow implant region being formed at a second depth above said amorphous pocket region;		
d) performing a SDE implant to form SDE regions of a second conductivity type using said gate structure as a mask;		
e) performing a source/drain implant procedure to form deep source/drain regions;		
f) performing an anneal procedure to recrystalize the amorphous shallow implant region and said amorphous pocket region, whereby said amorphous shallow implant region reduces defects formed by the pocket amorphizing implant.	Not suggest – no mention of reducing defects of halo implant	Not suggest – no mention of reducing defects of halo implant

As shown above, the combination of Saha and Lee do not suggest claim 8's limitations.

claims 2 and 9 are non-obvious

Claim 2 states:

2. (ORIGINAL) The method of claim 1 wherein the anneal procedure is comprised of a first soak step and a second spike step.

The office action posits that Saha (col. 7, L 23-33) suggest claim 2 and 8's 2 step anneal.

Saha (col. 7, L 23-33) states the following:

and more preferably about 500 eV. As will be shown with reference to FIG. 9, the impurities will diffuse through the substrate 100 to form the optimized source-drain wells that extends below the deep halo implant 112 after an annealing operation.

FIG. 9 shows an embodiment of the present invention after the transistor 138 has been subjected to a rapid thermal anneal (RTA) process. The rapid thermal anneal process is done at a temperature ranging from preferably about 900° C. to about 1100° C., and more preferably about 950° C. The time for the rapid thermal anneal process ranges from preferably about 5 seconds to about 60 seconds and more preferably about 10 seconds. After the rapid thermal anneal operation is completed, the deep source/drain (DSD) region 118 is defined.

Applicant could not find where Saha suggests a 2 step anneal nor a claim 2 or 9 anneal.

Rejection of Claims 7 and 16 under 35 U.S.C. 103(a) as being unpatentable over Saha in view of Lee as applied to claims 1 and 8 above, and further in view of Krishnan et al. (6,399,452).

The rejection of Claims 7 and 16 under 35 U.S.C. 103(a) as being unpatentable over Saha in view of Lee as applied to claims 1 and 8 above, and further in view of Krishnan et al. (6,399,452) is acknowledged. Reconsideration is respectfully requested.

claim 7 states:

> 7.(ORIGINAL) The method of claim 1 wherein the anneal procedure comprises: (1) a soak step at a temperature between 600 and 800 °C for a time between 10 and 30 seconds and (2) a spike step where the temperature ramps up to a peak temperature between 1000 and 1100 °C and a ramp down from said peak temperature to a temperature below 800 °C; said ramp up and ramp down have a rate between 200 and 300 degree °C per minute.

The office action cites Krishnan et al. (6,399,452) (col. 1, lines 28-34) as suggesting claims 7 and 16 anneal conditions.

Krishnan et al. (6,399,452) (col. 1, lines 28-34) states the following.

> dopant regions 106 (FIG. 1D). Subsequently, source/drain extension ("SDE") regions 107 and source/drain ("SD") regions 108 are created (FIG. 1E) by activating inactive dopant regions 104 and 106 by high temperature (e.g., 700° C. to 1100° C.) rapid thermal annealing. An n-channel MOS transistor can be similarly fabricated using appropriate dopants.

Applicant respectfully submits that Krishnan et al. (6,399,452) (col. 1, lines 28-34) does not suggest claims 7 and 16 limitations.

There is no suggestion combine this anneal with Saha 1 step anneal. (contrary to the office action page 5 that arguer that Saha shows a 2 step soak and spike anneal.). It is improper to combine Krishnan with the other references. Krishnan discloses a SDE and S/D anneal, not a pocket or halo anneal. There is no nexas or common problem or any other suggestion to combine these 3 patent except hindsight.

There is no suggestion to modify the combined 1 step anneals of saha and Krishnan to meet claims 7 and 16.

Krishnan et al. (6,399,452) teaches away from appl claims 7 and 16 limitations. Krishnan et al. col. 3, lines 55-66 that shows a halo implant at 950 C).

Rejection of Claims 3, 6, 10, 13 and 14 under 35 U.S.C. 103(a) as being unpatentable over Saha in view of Lee as applied to claims 1 and B above, and further in view of Yu (6,630,385) ('Yu '385').

The rejection of Claims 3, 6, 10, 13 and 14 under 35 U.S.C. 103(a) as being unpatentable over Saha in view of Lee as applied to claims 1 and B above, and further in view of Yu (6,630,385) ('Yu '385') is acknowledged. Reconsideration is respectfully requested.

The claims state:

3.(ORIGINAL) The method of claim 1 wherein said amorphous pocket region is formed at a depth between 40 and 100 nm; said amorphous pocket region has a thickness between 10 and 20 nm;
6.(ORIGINAL) The method of claim 1 wherein said amorphous shallow implant region is formed at a minimum depth of about 8 nm and a maximum depth of 20 nm below the substrate surface; said amorphous shallow implant region has a thickness between 5 and 10 nm.
10. (ORIGINAL) The method of claim 8 wherein said amorphous pocket region is formed at a depth between 40 and 100 nm; said amorphous pocket region has a thickness between 10 and 20 nm; and the substrate above the amorphous pocket region remains crystalline.
13. (ORIGINAL) The method of claim 8 wherein said amorphous shallow implant region is formed at a minimum depth of about 8 nm and a maximum depth of 20 nm below the substrate surface; said amorphous shallow implant region has a thickness between 5 and 10 nm.
14. (ORIGINAL) The method of claim 8 wherein said amorphous shallow implant region has a thickness between 5 and 10 nm.

All claims depend from non-obvious parent claims.

The office action on page 6 state:

However, Saha in view of Lee do not disclose the amorphous pocket region is formed at a depth between 40 and 100 nm and having a thickness between 10 and 20 nm; and the amorphous shallow implant region is formed at a minimum depth of about 8 nm and a maximum depth of 20 nm below the substrate surface and having a thickness between 5 and 10 nm.

The office action picks specific features out of context form Yu to combine with 2 other patent to attempt to meet applicant's claims.

First, it is improper to combine Yu with the 2 other patents. Yu's invention is a Halo I/I and anneal strategy that is complete by itself. Yu does not suggest combination with

Suhu and Lee. Moreover, any changes to Lec , and Suhu destroy the completeness of their patents. Yu have different Halo Implants (3 total) than Lee and suhu and different anneals. The combination can only be done by hindsight.

Second, the office action p. 6 posits that Yu forms a shallow amorphizing implant (like applicant's claimed shallow amorphizing implant). However, Yu does not appear to suggest or teach anywhere in his patent that the halo implants are amorphorizing. In fact, Yu performs a separate amorphorizing implant. (see Yu Abstract).

claims 3 and 10 are non-obvious

The office action states:

> Referring to claims 3 and 10, Yu '385 discloses the amorphous pocket region is formed at a depth between 40 and 100 nm (col. 2,lines 58-63).

However, Yu states that a doped halo implant is formed, not amorphous pocket region.

Claims 6 and 13 are non-obvious

The office action states;

Referring to claims 6 and 13, Vu '385 discloses the amorphous shallow implant region is formed at a minimum depth of about 10 nm and a maximum depth of 30 nm below the substrate surface

Yu (col. 3, lines 2-7) states:

US 0,0:

3

implant may be made with silicon, germanium, xenon or the like. As shown in FIG. 4, a second halo implant and source/drain extension implant are then performed. This shallow (approximately 10 nm to approximately 30 nm) halo implant is performed at a tilt angle of approximately 10° to approximately 60°, forming shallow halo region 14 and source/drain extensions 15. The second halo implant may be made with the same or different ion species as the first halo

Yu teaches against claims 6 and 13 by not teaching applicant's "amorphous shallow implant region ."

Yu forms a conventional amorphous region 12. See Yu col. 2, L 66 to col. 3, L5.

There is no motivation to combine Yu with Saha or Lee. There is no motivation to modify Yu to meet applicant's claims.

Claims 6 13 and 14 amorphous shallow implant region parameter are not routine optimizations.

The office action p. 7 argues that is routine optimization to come up with the claim 6 13 and 14 amorphous shallow implant region because the general conditions are known in the prior art. Application respectfully argues that the "amorphous shallow implant region " is novel and the conditions are not known.

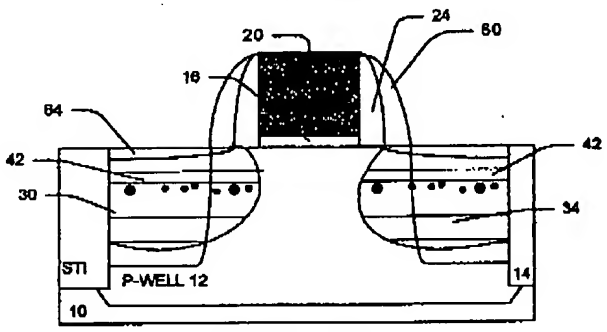


FIGURE 3A

Applicant's shallow amorphous shallow implant region is a new amorphous region that getter defects from deeper implants region 42 is not a halo implant.

Rejection of Claims 4 and 11 under 35 U.S.C. 103(a) as being unpatentable over Saha in view of Lee further in view of Yu'385 as applied to claims 1 and 8 above, and further in view of Yu (6,465,325) ("Vu '325").

Claims 4 and 11 depend from non-obvious parent claims.

Rejection of claims 17 and 19 under 35 U.S.C. 103(a) as being unpatentable over Saha in view of Lee, Vu '385 and Krishnan et al.

The rejection of claims 17 and 19 under 35 U.S.C. 103(a) as being unpatentable over Saha in view of Lee, Vu '385 and Krishnan et al. is acknowledged. Reconsideration is respectfully requested.

Claims 17 and 19 are non-obvious for the reasons give above for claim 1 and 8. Claims 17 and 19 containing further non-obvious limitations.

Rejection of Claim 18 under 35 U.S.C. 103(a) as being unpatentable over Saha in view of Lee, Yu '385 and Krishnan et al. as applied to claim 17 above, and further in view of Vu '325.

The rejection of Claim 18 under 35 U.S.C. 103(a) as being unpatentable over Saha in view of Lee, Yu '385 and Krishnan et al. as applied to claim 17 above, and further in view of Vu '325 is acknowledged. Reconsideration is respectfully requested.

Claim 18 depends from non-obvious claim 17.

New claims 21 22 and 23 are non-obvious

New claims 21 22 and 23 state:

21. (New) The method of claim 1 wherein said amorphous shallow implant region is not a halo region or a pocket region.
22. (NEW) The method of claim 1 wherein said wherein the shallow amorphizing implant comprises: implanting As, Si, or Ge species; said first conductivity type is p-type and said second conductivity type is n-type.
23. (NEW) The method of claim 1 wherein said wherein the shallow amorphizing implant comprises: implanting Si, Ge or N species.

Claim 21 is not new matter. The claim 5 claims non-dopant species: Si, Ge and N that are by definition halo or pocket implants. Halo and pocket regions by definition are the doped with the opposite impurity dopant and the S/D regions.

Both Saha and Lee teach against claims 21, 22 and 23. For claim 21, Saha and Lee teach the amorphous shallow implant region is a halo region.

For claim 22, Saha and Lee teach 2nd halo regions that are the p- doped. In contrast, the applicant's shallow amorphizing regions are Neutral or N-type. Claim 22 claims an preferred embodiment were an NMOS device is formed. See spec p. 10, LL 7 – 8.

For claim 23, Saha and Lee teach 2nd halo regions that are the p- doped.

New claim 24 is non-obvious

Claim 24 states:

24. (NEW) The method of claim 17 wherein said wherein the shallow amorphizing implant comprises: implanting Si , Ge or N species.

As discussed above, the other prior arts implant p dopants in their shallow halo implants.

Pending claims addressed

It is believed that all the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not bee expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper. and the amendment of any claim does not necessarily signify concession of the unpatentability of the claim prior to its amendment.

CONCLUSION

In conclusion, reconsideration and withdrawal of the rejections are respectfully requested. Allowance of all claims is requested. Issuance of the application is requested.

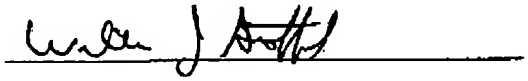
It is requested that the Examiner telephone the undersigned attorney at (215) 670-2455 should there be anyway that we could help to place this Application in condition for Allowance.

Charge to Deposit Account

The Commissioner is hereby authorized to apply any fees or credits in this case, which are not already covered by check or credit card, to Deposit Account No. 502018 referencing this attorney docket. The Commissioner is also authorized to charge any additional fee under 37 CFR §1.16 and 1.17 to this Deposit Account.

Respectfully submitted,

Date: Nov. 4, 2005



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